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Indian Standard
SPECIFICATION FOR
MATERIAL (NYLON WEBBING) FOR
AIRCRAFT SAFETY BELTS

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SPECIFICATION FOR MATERIAL (NYLON WEBBING) FOR AIRCRAFT SAFETY BELTS

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Indian Standard

SPECIFICATION FOR MATERIAL (NYLON WEBBING) FOR AIRCRAFT SAFETY BELTS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 25 October 1978, after the draft finalized by the Textile Materials for Aeronautical Purposes Sectional Committee had been approved by the Textile Division Council.

0.2 This standard is based on MIL-W-4088 Webbing, nylon, textile, latex impregnated, issued by the Department of Defence, United States of America.

0.3 The nylon webbing covered in this standard is used in making aircraft safety belts for which the Indian Standard Specification is under preparation.

0.4 To familiarize the industry with International System of Units (SI Units), the basic SI Units as well as the recommended SI Units for use in the textile industry are given in Appendix D.

0.4.1 Standards of Weights and Measures Act, 1976 also stipulates use of SI units.

0.5 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard covers nylon webbing, dyed or in natural colour, for manufacturing safety belts used by aircraft passengers.

*Rules for rounding off numerical values (revised).

2. MATERIAL

2.1 The nylon yarn used for making nylon webbing should be of high tenacity [0.7 N/tex (8 gf/d), *Min*] and count 93 tex (840 d).

3. MANUFACTURE

3.1 The webbing shall be well and evenly woven with firm selvages. The webbing may be treated as specified in the contract or order.

3.2 The webbing shall be either piece dyed or yarn dyed to the required shade. The dyeing shall be done before application of any finishing agent and before being impregnated with latex. Metallized or chrome dyes shall not be used.

3.3 In the manufacture of the webbing such dyestuffs, detergents, curatives, impregnating compounds, other chemicals or finishing agents shall not be used which are liable to cause deterioration under normal storage conditions, cause dermatitis on prolonged intimate skin contact or increase the flammability of the webbing.

4. REQUIREMENTS

4.1 The webbing shall meet the physical and chemical requirements given in Tables 1 and 2 respectively.

4.1.1 The webbing shall be woven in 2/2 harringbone twill weave with three reversals.

4.2 In respect of shade, tone and other requirements not covered in this standard, the nylon webbing shall not be inferior to the sealed sample agreed in the contract or order.

5. MARKING

5.1 Each roll shall be legibly marked with the following:

- a) Name of the material;
- b) Length of webbing (m);
- c) Year of manufacture or batch number; and
- d) Manufacturer's name, initials or trade-mark.

5.1.1 Each roll may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

TABLE 1 PHYSICAL REQUIREMENTS

(Clause 4.1)

SL No.	CHARACTERISTIC	REQUIREMENT	METHOD OF TEST
(1)	(2)	(3)	(4)
i)	Length/roll	100 m unless otherwise specified	IS : 1954-1969*
ii)	Width	50.0 ± 1.5 mm	
iii)	Ends in full width	196, <i>Min</i>	IS : 1963-1969†
iv)	Picks/dm	67, <i>Min</i>	
v)	Mass	75 g/m, <i>Max</i>	IS : 1964-1970‡
vi)	Thickness under a pressure of 20.6 kN/m ² (210 gf/cm ²)	1.9 mm, <i>Max</i>	IS : 7702-1975§
vii)	Breaking load on full width × 20 cm between grips	19.6 kN (2 000 kgf), <i>Min</i>	IS : 1969-1968
viii)	Shrinkage (thermal)¶	2 percent, <i>Max</i>	—

*Methods for determination of length and width of fabrics (*first revision*).

†Methods for determination of threads per decimetre in woven fabrics (*first revision*).

‡Methods for determination of weight per square metre and weight per linear metre of fabrics (*first revision*).

§Method for determination of thickness of woven and knitted fabrics.

||Method for determination of breaking load and elongation at break of woven textile fabrics (*first revision*).

¶Guidance may be obtained from IS : 4910 (Part IV)-1970 ' Methods of test for tyre yarns, cords and tyre cord fabrics made from man-made fibres: Part IV Heat shrinkage and heat-shrinkage force ' for heat shrinkage test.

6. PACKING

6.1 The webbing shall be made into rolls of 100 m unless otherwise specified in contract or order. Any roll may contain up to a maximum of 3 short length pieces provided none of the short length piece is less than 10 m in length. A suitable number of rolls shall be arranged in the form of cylindrical bundles and secured by jute twine to form a pack. A suitable number of such packs shall be wrapped in polyethylene film of at least 40 microns thickness and the bundles shall be placed in a wooden packing case lined with one layer of waterproof packing paper. The gross mass of the case shall not exceed 40 kg.

7. SHELF LIFE

7.1 The normal shelf life of webbing under ideal conditions should be 10 years. After this period, the webbing shall be retested and the shelf life extended by another 5 years.

TABLE 2 CHEMICAL REQUIREMENTS

(Clause 4.1)

SL No.	CHARACTERISTIC	REQUIREMENT	METHOD OF TEST
(1)	(2)	(3)	(4)
i)	Colour fastness to:		
	a) Light	5 or better	IS : 2454-1967*
	b) Washing	4 or better	IS : 765-1966† (using undyed nylon fabric for assessing the colour transfer or bleeding)
ii)	Resistance to abrasion	Shall not lose more than 5 percent of its original breaking load (1 900 kgf, Min)	Appendix F } of IS : 4727-1968‡
iii)	Resistance to accelerated weathering	Shall not lose more than 20 percent of its original breaking load (1 600 kgf, Min)	Appendix D } of IS : 4727-1968‡
iv)	Resistance to cold and pliability	Shall not display any appreciable stiffness or change in pliability	Appendix A
v)	Resistance to accelerated weathering (oven method)	Shall not be sticky or gummy and shall not lose more than 5 percent of its original breaking load (1 900 kgf, Min)	Appendix B
vi)	Resistance to combustion	Shall be flame resistant	Appendix C of IS : 2198-1971§

*Method for determination of colour fastness of textile materials to artificial light (xenon lamp).

†Method for determination of colour fastness of textile materials to washing: Test 4 (revised).

‡Specification for nylon webbing for aeronautical purposes.

§Specification for flax webbing for aeronautical purposes (first revision).

8. SAMPLING AND INSPECTION

8.1 The sampling and inspection procedure shall be as detailed in the contract or order; however, if so specified in the contract, the procedure as given in Appendix C may be followed.

NOTE — Indian Standard Sampling, inspection and testing scheme for aerospace textile materials is under preparation.

APPENDIX A

(Table 2)

METHOD FOR DETERMINATION OF RESISTANCE TO COLD AND PLIABILITY

A-1. TEST SPECIMENS

A-1.1 For the purpose of this test, all treated webbing rolls in the test sample shall constitute the test specimen.

A-2. PROCEDURE

A-2.1 The specimens shall be 20 cm long. One unaged webbing and another subjected to the accelerated weathering test shall be suspended in a cold chamber, maintained at a temperature of $-54 \pm 1^{\circ}\text{C}$ for $4\text{ h} \pm 15\text{ min}$. At the end of this period, the specimens, while in the cold chamber shall be flexed manually and their pliability shall be compared with an 'as received' specimen flexed outside the cold chamber at room temperature.

APPENDIX B

(Table 2)

METHOD FOR DETERMINATION OF RESISTANCE TO ACCELERATED WEATHERING (OVEN METHOD)

B-1. TEST SPECIMEN

B-1.1 For the purpose of this test, all the rolls in the test sample shall constitute the test specimen.

B-2. PROCEDURE

B-2.1 Take a specimen of treated webbing and keep it in an oven, maintained at a temperature of $70 \pm 1^{\circ}\text{C}$, for a period of 7 days. After expiry of seven days, remove the webbing and allow it to cool to room temperature. Examine whether the specimen is free from stickiness or gumminess and test it for breaking load, by the method given in Table 1.

APPENDIX C

(Clause 8.1)

PROCEDURE FOR INSPECTION AND TESTING

C-0. This sampling, inspection and testing scheme is based on that given in MIL-W-4088F Webbing, textile, woven, nylon, issued by the Government of USA.

C-1. RESPONSIBILITY FOR INSPECTION

C-1.1 Unless otherwise specified in the contract or purchase order, the supplier shall be responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any recognized testing laboratory acceptable to the purchaser. The purchaser reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to the prescribed requirements.

C-2. TYPE TESTS

C-2.1 For warp, weft and binder yarn, the following tests shall be carried out as type tests:

Identification,
Denier/tex,
Tenacity,
Luster,
Melting point,
Light resistance,
Heat resistance,
Unbleached,
Ply, and
Turns/twist.

NOTE — The supplier shall submit a certificate of compliance for these characteristics. The certificate shall be accompanied by actual test, inspection or other verifiable quality data.

C-3. OVERALL EXAMINATION

C-3.1 Each defect given below shall be counted not more than once in each roll examined which would be selected according to sampling plan given in C-4.2:

- a) Off shade (not within tolerance);
- b) Objectionable odour;

- c) Off shade, that is, not within established tolerance;
- d) Uneven dyeing, shaded, spottiness, poor penetration;
- e) Uneven weaving throughout; and
- f) Identification yarns misplaced, missing, or of wrong colour.

C-4. METRE BY METRE EXAMINATION

C-4.1 The required length of each piece shall be examined on both sides for visual defects classified as follows. All defects found shall be counted regardless of their proximity to one another, except where two or more defects represent a single local condition of the webbing; in that case only the more serious defect shall be counted. A continuous defect shall be counted as one defect for each warp-wise metre or of fraction thereof in which it occurs. The sample unit for this examination shall be one linear metre. No critical defect shall be allowed but Acceptance Quality Level for minor defects is 2.5/100 m of sample tested:

<i>Defect</i>	<i>Description</i>	<i>Critical</i>	<i>Minor</i>
1) Abrasion marks	Resulting in rupture of yarns or in neps sufficient to obscure the identity of any yarn exceeding 10 percent of width or 25 mm in length	×	
2) Broken or missing end	Two or more, regardless of length, a single and exceeding 150 mm in length Single end under 150 mm but exceeding 6 mm	×	×
3) Broken or missing pick	Two or more regardless of extent NOTE — The weft tie-in or joining shall not be construed as a defect of any nature	×	
4) Coarse or light weft bar	Resulting in visible difference in stiffness or thickness of webbing and extending for more than 6 mm in the length direction	×	

<i>Defect</i>	<i>Description</i>	<i>Critical</i>	<i>Minor</i>
	Resulting in visible difference in stiffness or thickness or webbing and extending for 6 mm or less in the length direction		×
5) Twist or distortion	Webbing shall not lay-in flat upon application of manual pressure due to twist or distortion		×
6) Cut, hole, or tear	Any cut, hole or tear	×	
7) Drop-ply	Clearly visible on more than 2 ends within same length and extending over 230 mm or more*	×	
	Clearly visible on 1 or 2 ends within same length and extending over 230 mm or more*		×
8) Edges	Frayed, slack or otherwise poorly constructed and exceeding 6 mm in length	×	
9) Floats or skins	Three or more 13-mm or more in combined warp and weft directions or single float or skip over more than 25 mm	×	

*Clearly visible at normal inspection distance (approximately 1 m),

<i>Defect</i>	<i>Description</i>	<i>Critical</i>	<i>Minor</i>
	Three or more, less than 13 mm in combined warp or weft directions or single float or skip over more than 13 mm but not exceeding 25 mm if in warp, or more than 6 mm of width but not exceeding 25 mm if in weft		×
10) Hitchback crack	Clearly visible opening between adjoining picks, or warp-wise tension area over part of the width resulting in visible light and heavy places*		×
11) Jerked-in weft, slough-off slug	A clearly visible weft loop pulled in at edges*		×
12) Kinks	More than 3 in any 230 mm	×	
13) Knots	More than 1 knot in any 230 mm	×	
	One knot every 2 m with untrimmed ends extending from surface of webbing		×
14) Mispick, double pick	Two or more across the full width	×	
	Single across the full width		×

*Clearly visible at normal inspection distance (approximately 1 m).

<i>Defect</i>	<i>Description</i>	<i>Critical</i>	<i>Minor</i>
15) Slack end	Two or more in the same length, jerked in between picks, or forming clearly visible loops on the surfaces	×	
	Single jerked in between picks or forming clearly visible loops on the surface		×
16) Slub, slug, gout	More than twice the thickness of the yarn (or ply, if plied)		×
17) Smash	Any smash	×	
18) Spot, stain or streak	Any clearly visible dirt, rust, grease, oil spot, stain or streak*		×
19) Tight end	Clearly visible up to 305 mm in length	×	
20) Wrong draw	Extending for more than 230 mm	×	
21) Width	Beyond specified tolerance		×

C-4.2 The following sampling plan may be employed for non-destructive tests:

<i>Lot Size</i> <i>m</i>	<i>Sample Size</i> <i>(Rolls)</i>	<i>Maximum Number of Defects</i> <i>Acceptable in Sample</i>
Up to 1 200	3	0
1 201 „ 3 200	5	0
3 201 „ 10 000	8	0
10 001 „ 35 000	13	0
35 001 „ 150 000	20	1
150 001 and over	32	2

*When webbing is to be in natural colour for use in special purpose items, any spot, stain or streak up to 305 mm in length that can be covered with an approved white spotter shall be minor. Any spot, stain or streak that can not be covered or is longer than 305 mm shall be a critical defect.

C-5. EXAMINATION FOR LENGTH OF INDIVIDUAL ROLL

C-5.1 Each roll in the sample shall be examined for the defects given below. The sample unit for this examination shall be one roll. The sample size and acceptance number shall be as given in **C-4.2**:

- a) Gross length less than that declared by more than 2 m,
- b) Any piece less than 10 m length, and
- c) Any roll containing more than 3 pieces.

C-5.2 Examination for Total Length in Sample — The lot shall be unacceptable if the total of the actual gross length of rolls in the sample selected in accordance with **C-4.2** is less than the total of the declared gross length.

C-6. TESTING OF FINISHED PRODUCT

C-6.1 Except for breaking strength, other requirements are average of the readings recorded for the test specimens against the relevant Indian Standards on methods of tests. The sample size shall be as follows:

<i>Lot Size</i>	<i>Sample Size</i>
m	m
Up to 800	2
801 to 22 000	3
Above 22 000	5

NOTE 1 — The length of webbing (m) supplied in a consignment shall form the lot.

NOTE 2 — In case of breaking strength no individual reading shall be less than that specified.

APPENDIX D

(Clause 0.4)

SI UNITS

TABLE 3 INTERNATIONAL SYSTEM OF UNITS

Base Units

QUANTITY	UNIT	SYMBOL
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

QUANTITY	UNIT	SYMBOL
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

QUANTITY	UNIT	SYMBOL	CONVERSION
Force	newton	N	1 N = 0.101 972 kgf
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m ²
Frequency	hertz	Hz	1 Hz = 1 c/s (s ⁻¹)
Electric conductance	siemens	S	1 S = 1 A/V
Pressure, stress	pascal	Pa	1 Pa = 1 N/m ²

TABLE 4 RECOMMENDED SI UNITS FOR TEXTILES

Sl No.	CHARACTERISTIC	SI UNIT		APPLICATION
		Unit	Abbreviation	
(1)	(2)	(3)	(4)	(5)
1)	Length	Millimetre Millimetre, centimetre Metre	mm mm, cm m	Fibre Samples and test specimens (as appropriate) Yarns, ropes and cordages, fabrics
2)	Width	Millimetre Centimetre Millimetre, centimetre Centimetre, metre	mm cm mm, cm cm, m	Narrow fabrics Other fabrics Samples and test specimens (as appropriate) Carpets, druggets, <i>DURRIES</i> (as appropriate)
3)	Thickness	Micrometre (micron) Millimetre	μ m mm	Delicate fabrics Other fabrics, carpets, felts
4)	Linear density	Tex Millitex Decitex Kilotex	tex mtex dtex ktex	Yarns Fibres Filament and filament yarns Slivers, ropes and cordages
5)	Diameter	Micrometre (micron) Millimetre	μ m mm	Fibres Yarns, ropes, cordages
6)	Circumference	Millimetre	mm	Ropes, cordages
7)	Threads in cloth:			Woven fabrics (as appropriate)
	a) Length	Number per centimetre Number per decimetre	ends/cm ends/dm	
	b) Width	Number per centimetre Number per decimetre	picks/cm picks/dm	
8)	Warp threads in loom	Number per centimetre	ends/cm	Reeds
9)	Stitches in knitted cloth:			Knitted fabrics (as appropriate)
	a) Length	Courses per centimetre Courses per decimetre	courses/cm courses/dm	
	b) Width	Wales per centimetre Wales per decimetre	wales/cm wales/dm	

(Continued)

TABLE 4 RECOMMENDED SI UNITS FOR TEXTILES — *Contd*

Sl No.	CHARACTERISTIC	SI UNIT		APPLICATION
		Unit	Abbreviation	
(1)	(2)	(3)	(4)	(5)
10)	Stitch length	Millimetre	mm	Knitted fabrics Made-up fabrics
11)	Mass per unit area	Grams per square metre	g/m ²	Fabrics
12)	Mass per unit length	Grams per metre	g/m	Fabrics
13)	Twist	Turns per centimetre Turns per metre	turns/cm turns/m	Yarns, ropes (as appropriate)
14)	Test or gauge length	Millimetre, centimetre	mm, cm	Fibres, yarns and fabric specimens (as appropriate)
15)	Breaking load	Millinewton Newton	mN N	Fibres, delicate yarns (skeins or individual) Strong yarns (individual or skeins), ropes and cordages, fabrics
16)	Breaking length	Kilometre	km	Yarns
17)	Tenacity	Millinewton per tex	mN/tex	Fibres, yarns (individual or skeins)
18)	Twist factor or twist multiplier	Turns per centimetre × square root of tex Turns per metre × square root of tex	turns/cm × $\sqrt{\text{tex}}$ turns/m × $\sqrt{\text{tex}}$	Yarns (as appropriate)
19)	Bursting strength	Newton per square centimetre	N/cm ²	
20)	Tear strength	Millinewton Newton	mN N	Fabrics (as appropriate)
21)	Pile height	Millimetre	mm	Carpets
22)	Pile density	Mass of pile yarn in grams per square metre per millimetre pile height	g/m ² /mm pile height	Pile carpet
23)	Elastic modulus	Millinewton per tex per unit deformation	mN/tex/unit deformation	Fibres, yarns, strands